

Supplementary information (SI)

Appendix A – Weather data

Table A1. Mean annual temperature (ann. temp.), annual precipitation sum (ann. prec. sum), mean temperature of summer months (summer temp., May-August) and summer precipitation sum (summer prec. sum, May-August) for the period 2014-2021 in Ruokolahti. s.d. = standard deviation.

Year	Ann. temp.	Ann. prec. sum	Summer temp.	Summer prec. sum
2014	4.95	562	14.18	331
2015	5.50	542	13.13	190
2016	4.44	729	14.70	403
2017	4.21	659	12.10	233
2018	4.54	520	15.68	178
2019	4.58	552	13.40	188
2020	5.93	622	13.53	220
2021	3.98	574	15.48	274
Mean	4.77	595	14.02	252
s.d.	0.66	70.24	1.22	79.58

Appendix B - Trees symptoms of SBB infestations (examples)

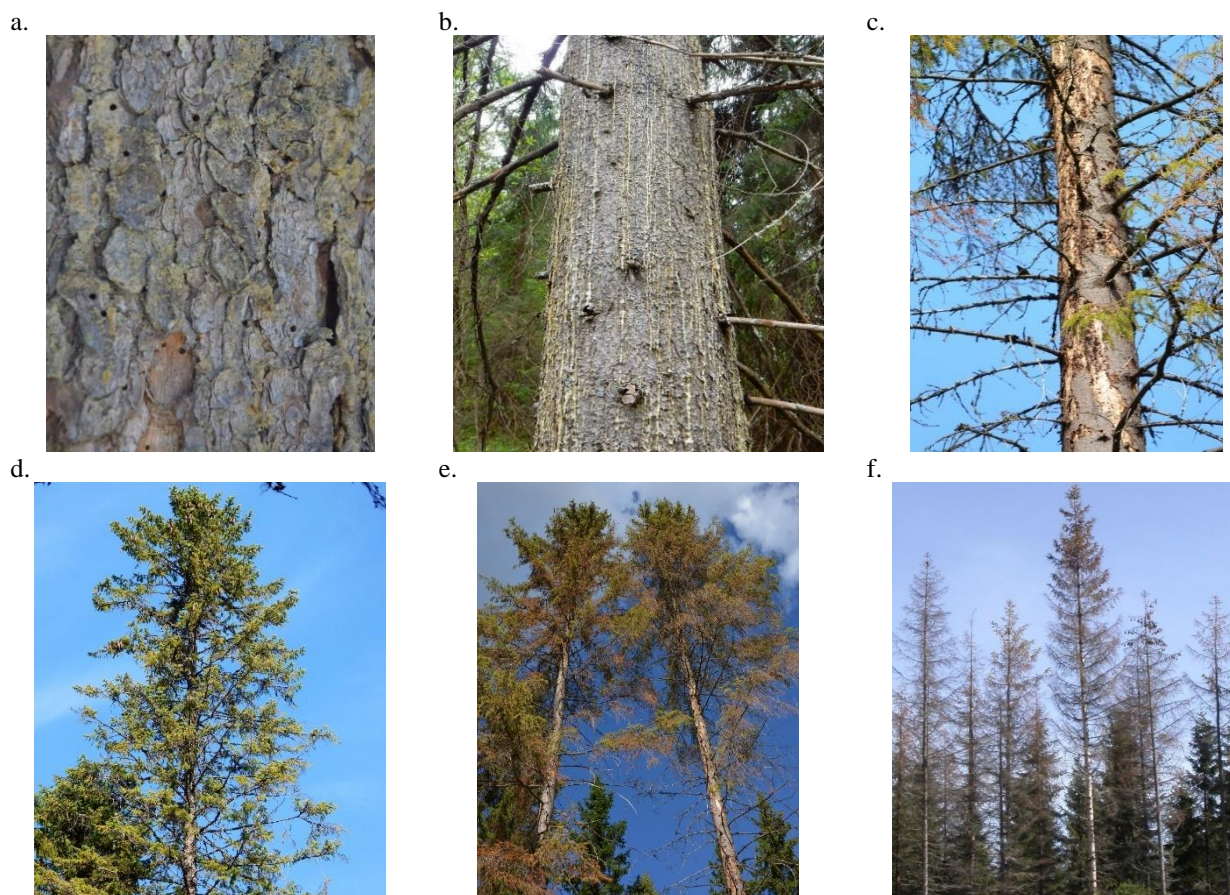


Fig. B1 Selected examples of classification of visible symptoms caused by SBB; a) over 10 holes up to 2 m height and a moderate bark damage, b) over 30 resin spots, c) high bark damage with yellow to red crown, d) a spruce with yellowish crown and defoliation of 25 - 49 %, e) spruces with a crown turning red and defoliation of 0 - 24%, f) spruces with dead grey crown and defoliation of 75 – 100%

Photos by Päivi Lyytikäinen-Saarenmaa

Appendix C - Figures

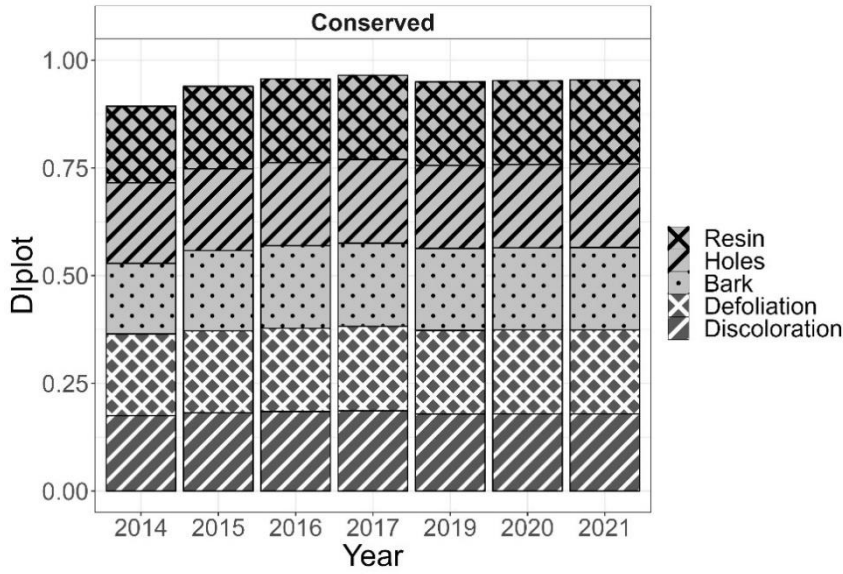


Fig. C1 The SBB damage index (DIplot) of the plots using data from 5 m radius from the centre of damage spot

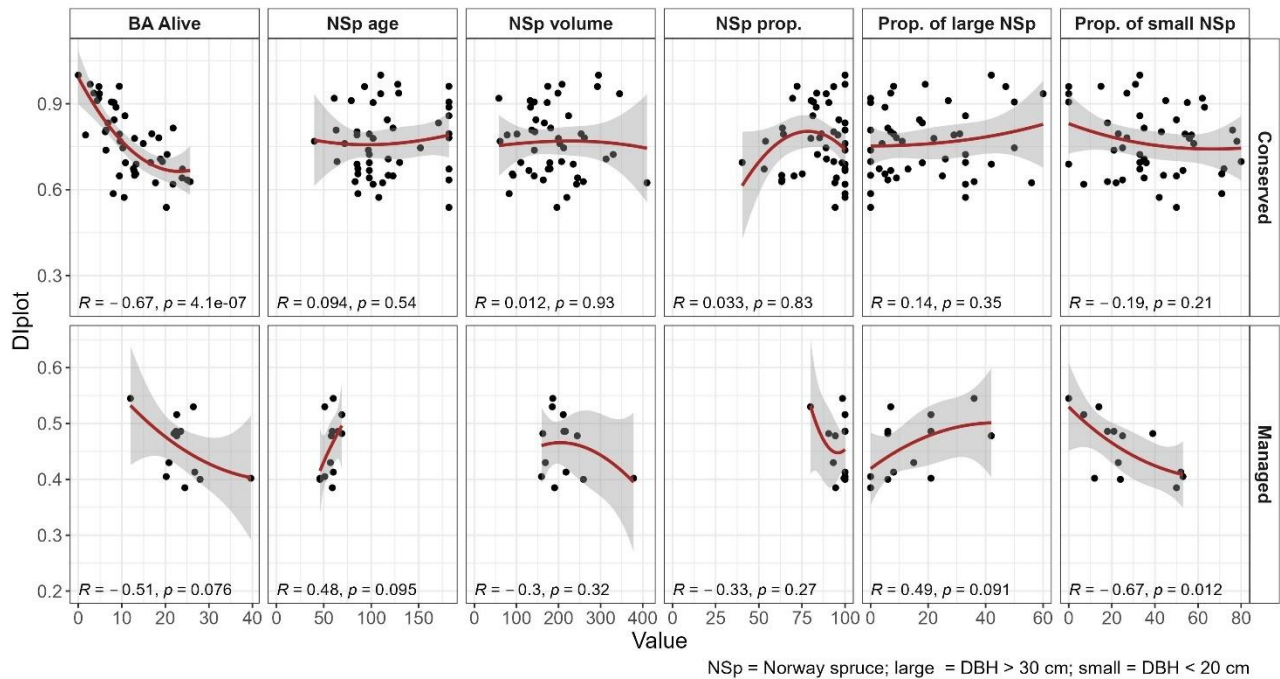


Fig. C2 The relation between the SBB damage index (DIplot) and stand variables in conserved and managed areas. Where 'BA Alive' is the basal area of alive trees (m²/ha), 'NSp age' is the average age of spruce (years), 'NSp volume' is the total volume of spruce (m³/ha), 'NSp prop' is the proportion of spruce (%), 'Prop. of large NSp' is the proportion of spruces larger than 30 cm (%), and 'Prop. of small NSp' is the proportion of spruce smaller than 20 cm. The line represents the local regression line (LOESS regression), used to fit a regression model for each variable (with a span value of 5)

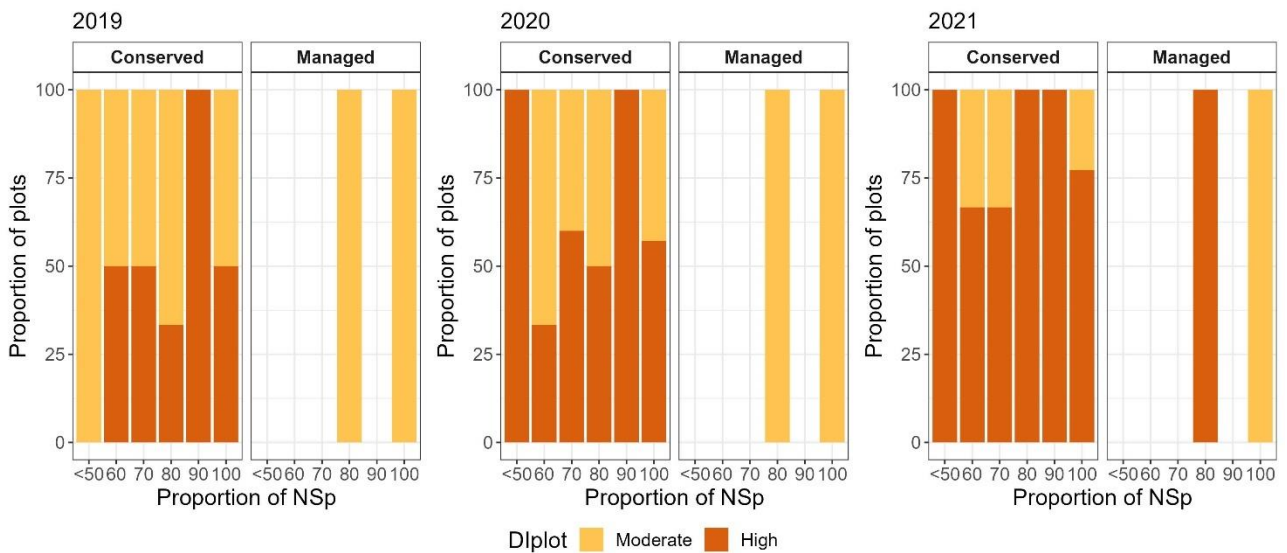


Fig. C3 The damage score classes shown for proportion of Norway spruce in the plots. Where in legend Low = DIplot 0-0.29, Moderate = DIplot 0.30-0.69, High = DIplot 0.70-1.0

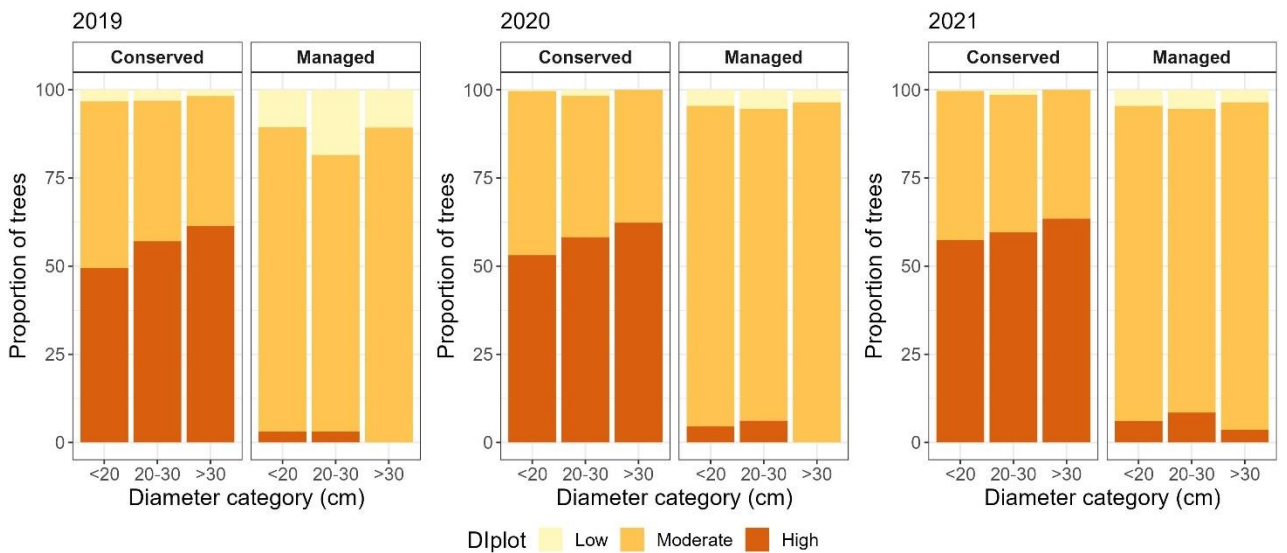


Fig. C4 The damage score classes shown for diameter classes of the trees. Where in legend Low = DIplot 0-0.29, Moderate = DIplot 0.30-0.69, High = DIplot 0.70-1.0

Appendix D – Statistical analysis results

Table D1. P-values of pairwise comparisons using Wilcoxon rank sum test with Bonferroni correction, showing differences in the way symptoms show the infestation intensity of the individual trees. A p-value < 0.05 means that there are significant differences between trees symptoms type. The differences were tested for 2019, 2020, and 2021.

Symptoms	Bark			Defoliation			Discoloration			Holes		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
Defoliation	< 0.05	< 0.05	< 0.05		<	<						
Discoloration	< 0.05	< 0.05	< 0.05	0.10	0.05	0.05						
Holes	< 0.05	< 0.05	< 0.05	0.20	0.06	0.05	<	<	<	0.05	0.05	0.05
Resin	< 0.05	< 0.05	< 0.05	0.05	0.05	0.05	<	<	<	0.05	0.05	0.05
										1.000	1.000	1.000

Table D2a. Mixed-design ANOVA test, showing differences in SBB damage (DIplot) between different treatments and years. The year was used as the within-group variable, and the treatment as the between-group variable.

Effect	df	MSE	F	p.value
Treatment (Conserved; managed)	61	0.03	65.32	<0.001
Year (2019, 2020, 2021)	60	0.00	135.71	<0.001
Treatment:Year	60	0.00	13.86	<0.001

Table D2b. Pairwise comparison results (using Tukey method), showing differences in SBB damage (DIplot) within years.

Period	Conserved	Managed
2019-2020	SE = 0.00239 t.ratio = -8.312 p.value < 0.0001	SE = 0.00468 t.ratio = -9.811 p.value < 0.0001
2020-2021	SE = 0.00249 t.ratio = -7.085 p.value < 0.0001	SE = 0.00489 t.ratio = -5.020 p.value = 0.0001
2019-2021	SE = 0.00389 t.ratio = -9.652 p.value < 0.0001	SE = 0.00765 t.ratio = -9.247 p.value < 0.0001

Table D2c. Pairwise comparison results (using Tukey method), showing differences in SBB damage (DIplot) between treatments (Conserved vs Managed) for each year.

Year	Conserved vs Managed
2019	SE = 0.03472 t.ratio = 8.257 p.value < 0.0001
2020	SE = 0.03301 t.ratio = 7.896 p.value < 0.0001
2021	SE = 0.03199 t.ratio = 7.932 p.value < 0.0001